## REMARKS

This amendment is filed in response to the Office Action dated October 6, 2006. In view of this amendment, this application should be allowed and the case passed to issue.

No new matter is introduced by this amendment. The amendment to claim 3 corrects an informality.

Claims 1-3 are pending in this application. Claims 1-3 are rejected. Claim 3 has been amended in this response.

### *Claim Rejections Under 35 U.S.C. § 103*

Claims 1 – 3 were rejected under 35 U.S.C. § 103 (a) as being unpatentable over Gyenge et al. (U.S. Pat. No. 7,060,391) in view of Ishikura et al. (U.S. Pat. No. 4,473,623). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The following is a comparison between the invention, as claimed, and the cited prior art.

An aspect of this invention, per claim 1, is a valve-regulated lead-acid battery comprising an electrode plate group and an electrolyte impregnated into and retained by the electrode plate group. The electrode plate group comprises positive electrode plates that each include a positive electrode current collector comprising a Sn-containing lead alloy, and a positive electrode active material retained by the positive electrode current collector. The electrode plate group further comprises negative electrode plates each including a negative electrode current collector comprising a lead alloy and a negative electrode active material retained by the negative electrode current collector and separators. The Sn content in the positive electrode current collector is 1.1 to 3.0 % by mass. Pore volume per unit mass of the negative electrode active material is 0.115 to 0.150 $cm^3/g$. Part of the electrolyte is a free electrolyte that is free from the electrode plate group and the free electrolyte is in contact with the separators.

Another aspect of the invention, per claim 3, is a valve-regulated lead-acid battery comprising a battery set. The battery set comprises a plurality of unit batteries that are connected in series. The unit batteries each comprising an electrode plate group and an electrolyte impregnated into and retained by the electrode plate group. The electrode plate group comprises positive electrode plates that each include a positive electrode current collector comprising a Sn-containing lead alloy and a positive electrode active material retained by the positive electrode current collector. The electrode plate group further comprises negative electrode plates each including a negative electrode current collector comprising a lead alloy and a negative electrode active material retained by the negative electrode current collector and separators. The Sn content in the positive electrode current collector is 1.1 to 3.0 % by mass. The pore volume per unit mass of the negative electrode active material is 0.115 to 0.150 $cm^3/g$. Part of the electrolyte is a free electrolyte that is free from the electrode plate group and the free electrolyte is in contact with the separators.

The Examiner characterized Gyenge et al. as disclosing (col. 6, lines 10 - 15) a lead-acid battery comprising positive electrode plates including positive current collectors (grids) formed of a Pb-Sn alloy, wherein the Sn content of the Pb-Sn alloy is in the range 0.5 to 2.0 % by weight. The Examiner acknowledged that Gyenge et al. (1) do not disclose impregnating the electrodes of the battery with electrolyte, and (2) do not specify the pore volume per unit weight of the negative electrode active material as being in the range of 0.115 to 0.150 $cm^3/gm$. In order to remedy deficiency (1) of Gyenge et al., the Examiner alleged that Ishikura et al. teach that "it is well known in the art to impregnate lead acid electrolytes [electrodes] with electrolyte in order to improve discharge storage characteristics." As for deficiency (2), the Examiner opined that '[w]ith respect to the pore volume per unit mass of the negative electrode, it would have been

obvious ... to employ the instant characteristics, since ... discovering the optimum value of a result effective variable involves only routine skill in the art." The Examiner further opined that "the pore volume per unit mass of the negative electrode, directly effects gas permeability of the electrode".

The rejections are vigorously traversed. Gyenge et al. and Ishikura et al., whether taken singly or in combination, fail to recognize the problem addressed and solved by the instant invention arising from two competing factors or tendencies present in the subject lead-acid batteries (as described in the "Best Mode" section of the application). Specifically, the instant invention addresses and solves the problem arising from the need to regulate the pore volume of the negative electrode active material in order to provide excellent gas ($O_2$) absorbing ability. However, regulation of the pore volume in order to provide excellent gas ($O_2$) absorbing ability results in a increase in the trickle charge current, thereby disadvantageously increasing corrosion of the Pb-Sn alloy-based positive electrode current collector (grid).

According to the instant invention, a valve-regulated lead-acid battery having a number of advantageous features and which avoids or obviates the abovementioned competing factors or tendencies is obtained by providing **positive** electrodes with current collectors (grids) made of a Pb-Sn alloy having an Sn content in the range 1.1 – 3.0 % by weight **and negative** electrodes with active material having pore volume per unit weight of the negative electrode active material in the range of 0.115 to 0.150 $cm^3/gm$. The claimed **combination** of positive and negative electrode features is neither disclosed or remotely suggested by either of the applied references, whether taken singly or in combination, and provides valve-regulated, electrolyte impregnated lead-acid batteries with excellent $O_2$ gas absorbing ability at the negative electrodes, excellent trickle life characteristics, and reduced corrosion of the positive electrode current collector. In

addition, when a plurality of the inventive batteries are connected in series, the charge voltages of the individual batteries are very similar. As a consequence, shortened trickle charge lifetimes of sets of batteries due to variation in charge voltages is suppressed or avoided.

It is noted that the Examiner simply discounted features of the present invention by asserting that "it would have been obvious . . . to employ the instant characteristics" and "that discovering the optimum value of a result effective variable involves only routine skill in the art." Accordingly, though the Examiner admitted that the prior art does not disclose the claimed pore volume per unit mass, the Examiner alleged that it would have been obvious based on optimization. However, it is respectfully submitted that the Examiner's reliance on routine skill in the art to allege obviousness of the claimed features is in legal error. The "optimum value" basis for an obviousness rejection can only be relied upon by the Examiner if the ***prior art*** first recognizes the modified parameter as a result-effective variable. In the instant case, only Applicants have recognized and considered the importance of the claimed parameters (e.g., the combination of Sn content in the positive electrode and pore volume per unit mass of the negative electrode, as a result-effective variable, so that the Examiner can not rely on the obviousness-theory of "optimum value of a result effective variable" as a basis for asserting obviousness thereof.

The Examiner is directed to MPEP § 2144.05(II)(B) under the heading "Only Result-Effective Variables Can Be Optimized", which sets forth the applicable standard for determining result-effective variables:

> A particular parameter must first ***be recognized*** as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. (citing *In re Antonie*, 195 USPQ 6 (CCPA 1977)) (emphasis added).

In the instant case, the cited prior art appears to be completely silent regarding the combination of the claimed Sn content of the positive electrode and the pore volume per unit mass of the negative electrode; so that there is no basis for alleging obviousness thereof based on discovering an optimum value of a result effective variable. Accordingly, it is respectfully submitted that the claimed features would not have been obvious in view of Gyenge et al. and Ishikura et al. because the cited prior art does not appear to recognize the claimed parameters, **in the particular combination set forth in the claims**, as achieving a recognized result.

Specifically, Gyenge et al. and Ishikura et al. fail to satisfy the legal requirement for the prior art to first recognize the pore volume per unit mass of the negative electrode active material is 0.115 to 0.150 $cm^3/g$ is a result-effective variable. Namely, Gyenge et al. and Ishikura et al. are silent as to the pore volume per unit mass of the negative electrode active material is 0.115 to 0.150 $cm^3/g$ achieving a recognized result. Accordingly, the cited prior art does not support the Examiner's allegation that discovering the claimed value of the pore volume per unit mass would have been obvious. Furthermore, Gyenge et al. and Ishikura et al. do not recognize that the combination of the claimed pore volume per unit mass of the negative electrode active material and the Sn content of the positive electrode is a result effective variable.

Moreover, the features of the present invention recited in claims 1 and 3 provide **new and unexpected results** in relation to valve-regulated, electrolyte impregnated lead-acid batteries providing excellent $O_2$ gas absorbing ability at the negative electrodes, excellent trickle life characteristics, and reduced corrosion of the positive electrode current collector, as described in the present specification. Only Applicants have recognized and considered the parameters (e.g., Sn content in the positive electrode current collector of 1.1 to 3.0 % by mass and pore volume per unit mass of the negative electrode active material of 0.115 to 0.150 $cm^3/g$) in relation to

valve-regulated lead acid batteries, as described in Applicants' specification. Gyenge et al. and Ishikura et al. are completely silent as to the improvement in $O_2$ gas absorbing ability at the negative electrodes, excellent trickle life characteristics, and reduced corrosion of the positive electrode current collector achieved by the present invention, and does not enable optimization of the claimed parameters.

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge readily available to one of ordinary skill in the art. *In re Kotzab*, 217 F.3d 1365, 1370 55 USPQ2d 1313, 1317 (Fed. Cir. 2000); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). There is no suggestion in Gyenge et al. and Ishikura et al. to provide a valve-regulated lead-acid battery wherein the Sn content in the positive electrode current collector is 1.1 to 3.0 % by mass and pore volume per unit mass of the negative electrode active material is 0.115 to 0.150 $cm^3/g$, as required by claims 1 and 3.

The mere fact that references can be modified does not render the resulting combination obvious unless the prior art also suggests the desirability of the modification. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Gyenge et al. and Ishikura et al. do not suggest the desirability of modifying a valve-regulated lead-acid battery so that the Sn content in the positive electrode current collector is 1.1 to 3.0 % by mass and pore volume per unit mass of the negative electrode active material is 0.115 to 0.150 $cm^3/g$, as required by claims 1 and 3.

The requisite motivation to support the ultimate legal conclusion of obviousness under 35 U.S.C. § 103 is not an abstract concept, but must stem from the applied prior art as a whole and

realistically impel one having ordinary skill in the art to modify a specific reference in a specific manner to arrive at a specifically claimed invention. *In re Deuel*, 51 F.3d 1552, 34 USPQ2d 1210 (Fed. Cir. 1995); *In re Newell*, 891 F.2d 899, 13 USPQ2d 1248 (Fed. Cir. 1989). Accordingly, the Examiner is charged with the initial burden of identifying a source in the applied prior art for the requisite realistic motivation. *Smiths Industries Medical System v. Vital Signs, Inc.*, 183 F.3d 1347, 51 USPQ2d 1415 (Fed. Cir. 1999); *In re Mayne*, 104 F.3d 1339, 41 USPQ2d 1449 (Fed. Cir. 1997). The Examiner has not identified any motivation in Gyenge et al. and Ishikura et al. to modify the battery of Gyenge et al. to provide a valve-regulated lead-acid battery wherein the Sn content in the positive electrode current collector is 1.1 to 3.0 % by mass and pore volume per unit mass of the negative electrode active material is 0.115 to 0.150 $cm^3/g$, as required by claims 1 and 3.

The only teaching of the claimed battery is found in Applicants' disclosure. However, the teaching or suggestion to make a claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Claim 2 is allowable for at least the same reasons as claim 1, and further distinguishes the claimed invention.

In view of the above amendments and remarks, Applicants submit that this application should be allowed and the case passed to issue. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper,

including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

McDERMOTT WILL & EMERY LLP

Bernard P. Codd

Bernard P. Codd
Registration No. 46,429

600 13th Street, N.W.
Washington, DC 20005-3096
Phone: 202.756.8000 BPC:MWE
Facsimile: 202.756.8087
**Date: January 5, 2007**

**Please recognize our Customer No. 20277 as our correspondence address.**